valid *legal* reasons for physician-initiated blood alcohol concentrations. When blood alcohol concentrations are used to provide realistic individualized patient guidelines regarding drunken driving, legal issues become moot: the patient's health becomes the only motivating factor, and the use of blood alcohol concentrations becomes equivalent to any other laboratory test obtained for diagnosis and treatment.

It is possible, given a blood concentration, to predict on average how long it will take for the level to decrease to a specified level.* This information can be used to provide impaired patients with a written "driving prescription" indicating the minimum time during which driving should be avoided. Since patients will vary in their metabolism of alcohol, the "driving prescription" should be conservatively based on time to a blood alcohol level of zero. The written prescription serves several useful purposes: it encourages physicians to provide realistic advice tailored to the individual patient; serves as a reminder for the sobering patient should they forget verbal instructions; should be medically acceptable; and demonstrates physician concern with the health consequences of driving while impaired.

Any diagnostic test should be obtained only for medical reasons that might lead to some benefit for the patient. This implies that action will be taken once the results of the test are known. More liberal use of blood alcohol concentrations might lead to advice for impaired patients, who are not obviously intoxicated, to refrain from driving. Such advice, if translated to fewer traffic crashes, would improve patient care. Since driving while impaired creates tremendous health risks, an explicit "driving prescription" may be an important medical intervention that could also promote highway safety.

*The average time to a specified alcohol level, along with other relevant parameters regarding alcohol drinking, can be predicted using the ©Alco-Calculator (Alcohol Research Documentation, Inc., Rutgers University Center of Alcohol Studies, New Brunswick, NJ). The calculation assumes drinking has stopped sometime prior to the obtained blood alcohol concentration and is an estimation based on the population average.[10]

ACKNOWLEDGMENTS

The authors wish to thank Patricia Waller, PhD, and Francis A. Neelon, MD, for useful suggestions during preparation of the manuscript. This research was supported in part by a grant from the A. W. Mellon Foundation and the Veterans Administration Project #87F010.

REFERENCES

1. Soderstrom CA, Cowley RA: A national alcohol and trauma center survey. Arch Surg 1987; 122:1067–1071.
2. Yates DW, Hadfield JM, Peters K: Alcohol consumption of patients attending two accident and emergency departments in north-west England. J R Soc Med 1987; 80:486–489.
3. Waller PF, Stewart JR, Hansen AR, Stutts JC, Lederhaus CL, Rodgman EA: The potentiating effects of alcohol on driver injury. JAMA 1986; 256: 1461–1466.
4. McLean S, Parsons RS, Chesterman RB, Dineed R, Johnson MG, Davies NW: Drugs, alcohol and road accidents in Tasmania. Med J Aust 1987; 147:6–11.
5. AMA Council on Scientific Affairs: Alcohol and the Driver. JAMA 1986; 255:522–527.
6. Widmark EMP. Principles and application of medicolegal alcohol determination. Davis, CA: Biomedical Publications, 1981.
7. Lundberg GD: Let's stop driving after drinking and using other psychoactive drugs. JAMA 1986; 255:529–530.
8. Gibb K: Serum alcohol levels, toxicology screens, and use of the breath alcohol analyzer. Ann Emerg Med 1986; 15:349–353.
9. Fairey WF: Ordering a blood alcohol level in the emergency room: A medical-legal dilemma. J SC Med Assoc 1986; 82:536–537.
10. Winek CL, Esposito FM: Blood alcohol concentrations: factors affecting predictions. *In:* Wecht WH (ed): Legal Medicine. New York: Praeger, 1985.

Prescribing of Noncontraceptive Estrogens and Progestins in the United States, 1974–86

ELINA HEMMINKI, MD, DIANNE L. KENNEDY, RPH, MPH, CARLENE BAUM, PHD, AND SONJA M. MCKINLAY, PHD

Abstract: This paper describes changes in the prescribing of noncontraceptive estrogens and progestins, using data from pharmaceutical marketing surveys. The number of estrogen prescriptions decreased from 1975 to 1980, and then increased through 1986. Progestin use has increased since 1982; concomitant use of estrogens and progestins increased over time and was common in 1986. The trends suggest that the use of estrogens, particularly the combined use of estrogens and progestins, will continue to increase. (*Am J Public Health* 1988; 78:1478–1481.)

Introduction

Both positive and negative health effects of estrogen use have been reported.[1–5] Nevertheless, it is important to be aware of changes over time in the use of estrogens and of the characteristics of women exposed in order to estimate the public health importance of any effects. The notable changes in the quantity of prescribing of noncontraceptive estrogens in the United States from 1966 to 1983 has recently been described.[6] This paper describes the changes in the patterns of and indications for prescribing of noncontraceptive estrogens from 1974 to 1986.

Methods

Data were derived from two pharmaceutical marketing research data bases purchased by the Food and Drug Administration (FDA) from IMS America, Ltd, Ambler, PA: the National Prescription Audit (NPA) and the National Disease and Therapeutic Index (NDTI).[6,7] The NPA gives national estimates of prescription volume based on prescriptions dispensed by a panel of retail pharmacies. The NPA data presented are for all dosage forms of estrogen and include estrogen/androgen combination products.

The NDTI provides descriptive information on disease patterns and treatment in office-based practice in the US. A

Address reprint requests to Elina Hemminki, MD, Department of Public Health, University of Helsinki, Haartmanink 3, 00290 Helsinki, Finland. This study was done while she was with the American Institutes for Research, Cambridge Research Center. Dr. McKinlay is Principal Research Scientist with the Cambridge Research Center, American Institutes for Research; Ms. Kennedy and Dr. Baum are with the Division of Epidemiology and Surveillance, Food and Drug Administration, 5600 Fishers Lane, Rockville, MD 20857. This paper, submitted to the Journal September 29, 1987, was revised and accepted for publication April 13, 1988.

panel of over 2,000 physicians report on each patient seen or contacted (patient *visit*) in any way (office, hospital, telephone) during a 48-hour period each quarter. There are no published reports on the quality of the NDTI data, but we have assumed the possible biases to be similar over time, and the data valid for secular comparisons. Drugs reported during a patient visit ("mentions") may have been given as a formal prescription, hospital order, directly dispensed or administered, or just recommended. Concomitant use of drugs means drugs prescribed for the same diagnosis, and does not include drugs ordered for the same patient for different diagnoses. When regional variation was studied, the total number of drug mentions regardless of age was divided by the estimated number of women aged 45–64 years in the region.[8,9,10]

Results

The previously reported increase in estrogen prescription volume from 1980 to 1983 has continued through 1986, (Figure 1). In 1983, 16.6 million prescriptions for estrogen-containing products were dispensed, and in 1986 20.3 million: 37 per cent new and 63 per cent refills. Oral estrogens accounted for 88 per cent of estrogen prescriptions in 1986, with Premarin® still the most commonly used preparation. Vaginal estrogen products show little variation over time (2 million in 1986), and androgen/estrogen preparations are down from 7 per cent in 1974 to 1 per cent in 1986.

According to the NDTI data, the use of injectable estrogen has decreased from 5.0 million doses in 1974 to 1.8 million doses in 1986 while the use of oral estrogens increased 117 per cent between 1979 and 1986. Because each injection requires a patient visit, they get disproportionately more emphasis in the NDTI than oral estrogens. To minimize confounding that might be caused by the decreased use of injectable estrogens over time, further NDTI data on time trends will mainly concern oral estrogens.

The rate of prescribing of oral estrogens varied notably by region in the US, being lowest in the East and highest in the West (Table 1). Differences between the areas increased from 1974 to 1985, but the rankings remained the same. Similar differences were found for all estrogens. The share of oral estrogens prescribed by gynecologists rose while that prescribed by general/family practitioners declined from 1974 through 1986.

Oral estrogens were used mainly in women (92 per cent in 1986), aged 40–59 years (Table 2). In different years from

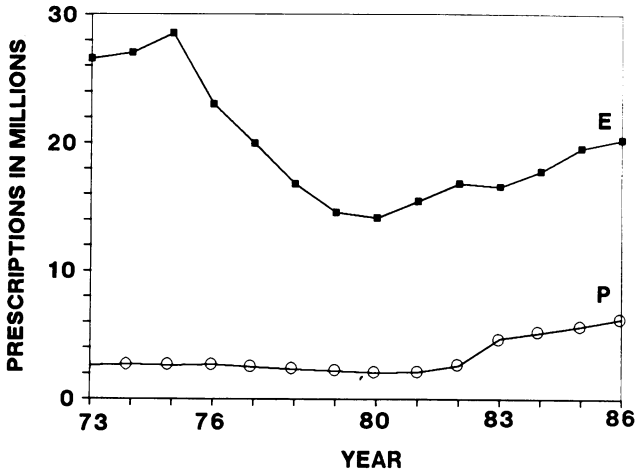

FIGURE 1—Numbers of Dispensed Prescriptions Containing Estrogens (E) and Progestogens (P) in 1973–86, in Millions (the NPA data).

TABLE 1—Rates of Total Oral Estrogen Mentions per 100 Women Ages 45–64 Years by Region, United States, 1974–85

Region	1974	1976	1979	1982	1985
	Rates/100 Women				
East	30	23	11	11	15
Midwest	38	29	14	25	27
South	34	19	15	17	26
West	45	36	18	31	43

SOURCE: National Disease and Therapeutic Index (NDTI), IMS America and US Department of Commerce.

66 to 82 per cent of oral estrogens were prescribed for problems associated with menopause or post-menopausal changes. The other important indication was cancer.

Other drugs have been frequently prescribed along with an estrogen (Table 3). Concomitant use of progestins increased substantially during the 1980s.

The NPA shows that the total number of progestin (P) prescriptions rapidly increased between 1984 and 1986 (Figure 1). In 1979, oral progestins were given mainly to women under age 40 (71 per cent of use), they were used alone (79 per cent), and for first-time therapy (81 per cent); menopausal problems represented only 18 per cent of the diagnoses. In 1986, oral progestins were given to women 40 years and older (68 per cent), only 37 per cent were used alone, 52 per cent were new therapy, and menopausal indications represented 59 per cent of diagnoses.

"Menopausal symptoms" was the most common diagnosis for which estrogens were prescribed (from 32 to 46 per cent of all estrogen use each year), as shown in Table 4. A drug was prescribed in most of the visits for "menopausal symptoms", and the use of oral estrogens and progestins in the treatment of "menopausal symptoms" has increased.

The number of visits with the diagnosis "osteoporosis" was 1.4 million in 1974 and 1.8 in 1986. The majority of visits (from 86 to 96 per cent) were made by women, and in 1974–82 most of them were age 60 or older. Since 1982, the proportion of visits by women ages 40–59 years have increased (up 17 per cent in 1986). The importance of non-combination estrogens in therapy increased from 1974 to 1986, and in 1986 over one-fourth of the patients received oral estrogens. However, calcium supplements were the most commonly prescribed therapy throughout the 1980s.

Discussion

The increase in estrogen prescriptions which began in 1980 continued through 1986, but the highest level was still

TABLE 2—Per Cent Distribution of Oral Estrogen Mentions by Patient Age, 1974–86

Age Groups[a]	1974	1976	1979	1982	1985	1986
0–19 (years)	1	2	2	—	1	1
20–39	17	17	22	21	11	13
40–59	67	64	57	60	63	62
60–64	6	8	6	9	9	10
65+	8	9	13	10	16	15
TOTAL	100	100	100	100	100	100

SOURCE: National Disease and Therapeutic Index, IMS America.
a) Females only

TABLE 3—Per Cent Distribution of Mentions of the Concomitant Use of Oral Estrogens with Selected Other Drugs, 1974–86

Estrogen Use	1974	1976	1979	1982	1985	1986
Used alone	65	67	71	63	53	52
With oral progestogens	2	5	4	9	23	28
With calcium	—	—	2	3	6	5
With benzodiazepines	5	3	3	2	2	2

SOURCE: National Disease and Therapeutic Index, IMS America.

somewhat lower than in the peak year of 1975. The increase in the prescribing of progestins started somewhat later (after 1982) and coincided with a trend toward the use of an oral progestin along with an oral estrogen. Injectable forms of estrogens and estrogen/androgen combinations have lost their popularity with time. These changes may be due to changes in prescribing habits or in the specialty of prescribing physicians.

As the overall prescribing went down, prescriptions for menopausal symptoms were most affected, prescriptions for surgical menopause and cancer less affected. This is also reflected in the sex and age distribution of patients receiving estrogens.

When the number of NDTI drug mentions for estrogens dropped by 59 per cent from 1974 to 1979, there was only a small drop (16 per cent) in the proportion of women with "menopausal symptoms" who were treated with oral estrogens. In contrast there was a large drop (64 per cent) in the number of visits in which this diagnosis was given. There are two possible explanations for this finding: it may be that treatment determined recording of diagnosis, and visits not having any prescriptions were underreported in the NDTI data base; or that women changed their help-seeking behavior, and the changes in the number of visits were real.

Osteoporosis as a distinctive diagnosis in estrogen therapy was rare although it became somewhat more common over time. However, the classification of reasons for visits in NDTI emphasizing the underlying problem rather than the aim of the treatment may underestimate the prevention of osteoporosis as a reason for estrogen therapy.

Consistent with earlier studies,[11,12] this survey showed that if a woman consults a doctor because of menopausal problems, she is very likely to get a prescription for estrogens. Given the purported benefits of estrogens and combined estrogen-progestin treatment, including claims that they are protective against cardiovascular diseases, and current concerns about osteoporosis, it appears that increased prescribing of estrogens will continue for some time.

TABLE 4—Treatment of Women with the Diagnosis of "Menopausal Symptoms", 1974–86

Patient Visits	1974	1976	1979	1982	1985	1986
Estimated visits (in millions)	9.4	7.2	3.4	4.1	5.7	6.2
	Per Cent of Visits					
Visits with drugs	89	83	78	81	80	81
Type of drug[a]						
Oral estrogens	37	33	31	39	45	52
Injected estrogens	36	31	27	25	18	14
Injected androgen-estrogens	7	7	5	4	3	3
Oral progestogens	1	2	2	6	16	20
Benzodiazepines	6	6	4	4	2	2
Vitamin B12	4	5	3	6	2	2

Source: National Disease and Therapeutic Index, IMS America.
a) Only drugs prescribed in at lesat 5% of visits in any year are included.

ACKNOWLEDGMENTS

The work of Dr. Hemminki was supported by a grant from the National Institute on Aging (grant No. AGO 3111). The opinions expressed in this paper are those of the authors and not necessarily those of the Food and Drug Administration.

REFERENCES

1. Stampfer MJ, Willett WC, Colditz GA, *et al:* A prospective study of postmenopausal estrogen therapy and coronary heart disease. N Engl J Med 1985; 313:1044–1049.
2. Wilson PWF, Garrison RJ, Castelli WP: Postmenopausal estrogen use, cigarette smoking, and cardiovascular morbidity in women over 50. N Engl J Med 1985; 313:1038–1043.
3. Buring JE, Bain CJ, Ehrmann RL: Conjugated estrogen use and risk of endometrial cancer. Am J Epidemiol 1986; 124:434–441.
4. Bush TL, Barrett-Connor E: Noncontraceptive estrogen use and cardiovascular disease. Epidemiol Rev 1985; 7:80–104.
5. Wingo PA, Layde PM, Lee NC, *et al:* The risk of breast cancer in postmenopausal women who have used estrogen replacement therapy. JAMA 1987; 257:209–215.
6. Kennedy DL, Baum C, Forbes MB: Noncontraceptive estrogens and progestins: use patterns over time. Obstet Gynecol 1985; 65:441–446.
7. Strom BL, Melmon KL, Miettinen OS: Post-marketing studies of drug efficacy: why? Am J Med 1985; 78:475–480.
8. US Department of Commerce: Population estimates and projections. P-25, No 875. Washington, DC: The Department, 1980.
9. US Department of Commerce: State populations and household estimates to 1985 with age and components of change. P-25, No 998. Washington, DC: The Department, 1986.
10. US Department of Commerce: General population characteristics. PC 80-1-B1. Washington, DC: The Department, 1983; 1–62.
11. Pasley BH, Standfast SJ, Katz SH: Prescribing estrogen during menopause: physician survey of practices in 1974 and 1981. Public Health Rep 1984; 99:424–429.
12. Barrett-Connor E: Premenopausal estrogens—current prescribing patterns of San Diego gynecologists. West J Med 1986; 144:620–621.